As INL's technical director for TRISO fuel research, Idaho National Laboratory Fellow Dave Petti heads a project to further develop a more efficient fuel for high-temperature gas-cooled nuclear reactors.

INL engineer's long-term nuclear fuel research pays off

by Megan Crepeau, *Nuclear Science & Technology Communications*

Science doesn't happen overnight, and Idaho National Laboratory Fellow Dave Petti knows that better than many. His research has required a long-term commitment from him and his colleagues — one that is starting to pay off as the products of their work are breaking barriers and receiving national consideration.

As INL's technical director for TRISO fuel research, Petti has recently become the poster boy for that research, with interviews in trade publications and attention from local media. The notice is well-deserved, as Petti's team is on its way to achieving a major milestone in fuel performance that could have important implications for the country's nuclear future.

"This is the long pole in the tent," Petti said. "It's finally got the momentum and the money to keep it going."

Tri-isotopic fuel, or TRISO fuel, is a specialized fuel intended for high-temperature gas reactors. As opposed to light water reactor fuel, TRISO fuel is a spherical particle with uranium dioxide or uranium oxycarbide at its core. The core is coated with layers of carbon and silicon carbide — the TRISO coating — which acts as "the primary containment" of fission products.

The tiny particles, which measure about one millimeter in diameter, are embedded in graphite, which takes the form of a tennis ball-sized pebble or a circular cylinder depending on the reactor where it will be placed. TRISO fuel is unique, according to Petti, in that it can be fabricated with very few defects, survive severe accident conditions and — most importantly — achieve a burnup that goes far beyond any previous research.

As of early September, the TRISO fuel had been in INL's Advanced Test Reactor for more than a year and a half and had achieved 12.5 percent burnup – no small feat, considering that light water reactor fuel generally achieves no more than 3 or 4 percent burnup.

This breakthrough comes after a long dry spell for TRISO research. TRISO fuel testing was largely abandoned internationally in the early 1990s, at the end of the Cold War, despite breakthroughs from Germany in the 1980s. The United States began having difficulties with its research in the area, and budget cuts effectively ended any hopes of solving those difficulties — as Petti put it, "and then, that all went away." The project was left for dead until 2003, when climate change and Generation IV goals prompted renewed interest in nuclear energy.

"[Gen IV research] was the spark plug that started it," Petti said.

Petti and his team, most of whom had worked on TRISO research in the 1990s, were instructed to pick up where they left off, gleaning information from German records to help them break past the barriers that had stalled them a decade earlier. It took three years for the correct equipment to be installed, and proper testing began in 2006.

The overall aims of the TRISO project are within reach now, Petti said. INL hopes to achieve 16 to 17 percent burnup in June 2009, after which the fuel will go in for testing under accident condition simulations.

"The goal of the project is to qualify fuel for use in gas reactors," Petti said. "So four to five years from now [it] should be well on its way."

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